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GIRDLING GRAPE VINES

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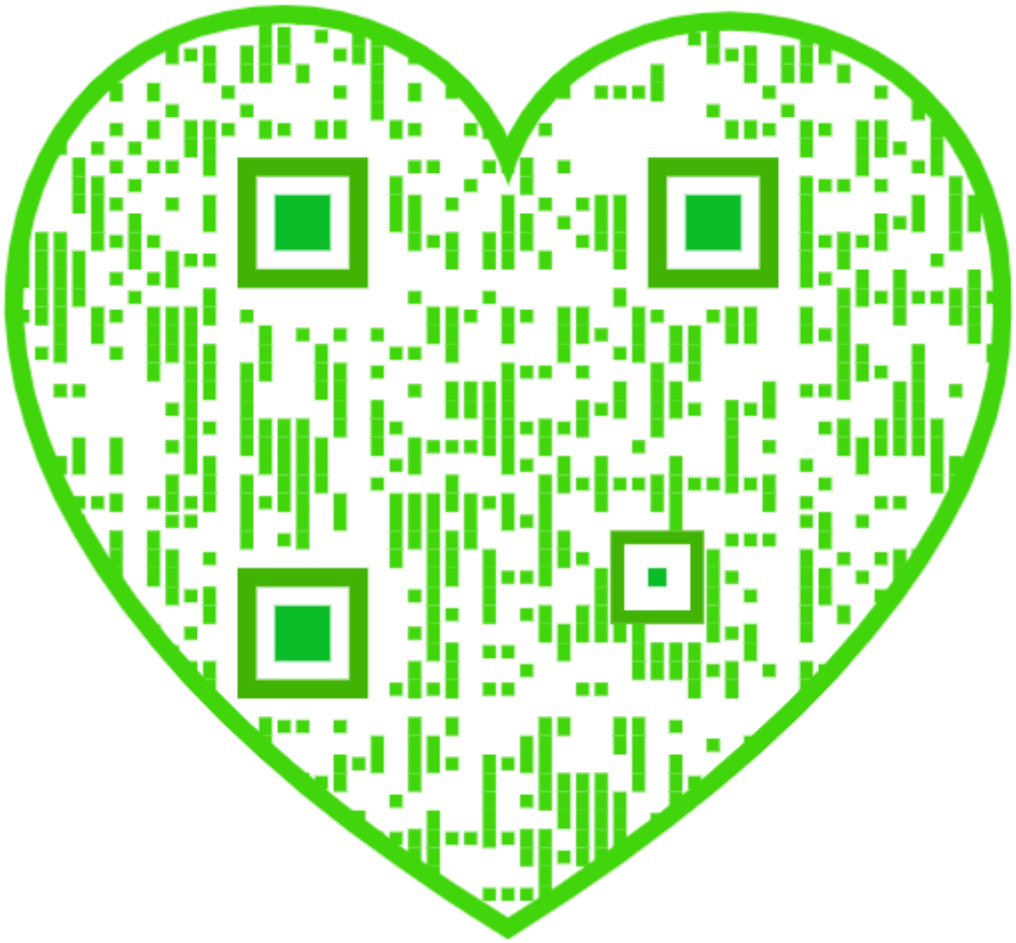

GIRDLING GRAPE VINES

H. E. JACOB[1]

Interest in the practice of girdling Thompson Seedless (Sultanina) vines for the production of table grapes has increased greatly in California during the past three seasons, and the time seems not far distant when most of the Thompson Seedless grapes produced for table use will be from girdled vines. The practice of girdling Black Corinth for the production of the "Zante" currant raisins of commerce is an old one, and is in use wherever this variety is grown.

DEFINITION OF GIRDLING

Girdling, as it is practiced in commercial vineyards, consists in the removal of a ring of bark from 3/32 to 3/16 inch wide entirely around some member of the vine. It may be done on the trunk, on the arms, or on the fruit canes or spurs. Girdling on the arms is not advisable, first, because of the difficulty and expense of doing the work, due to their knotty, gnarled nature and their covering of rough, hard outer bark; and, second, because of the slow and imperfect healing of the wounds. Nearly all of the varieties on which girdling is practiced are regularly cane-pruned; that is, the fruiting units consist of relatively long portions of the growth of the previous season (fruit canes). With such varieties, the girdling can be economically and effectively done on either the trunk or the individual fruit canes. Girdling the trunk affects the entire vine, while girdling the individual canes affects to any great extent only those portions above or beyond the girdle.

It is essential that the ring of bark be *completely* removed entirely around the member girdled. Even if only a small section of the ring of bark is left there may be little or no response to the operation. The immediate effect of the girdle is to interrupt the normal movement of food materials so that the proportion of carbohydrate material, such as sugars and starches, to nitrogenous and other nutrients is increased in the parts beyond the wound. If a small section of uncut bark is left, the transfer of materials is not sufficiently interrupted to produce the desired effects.

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The girdling should be done in such a way that the wounds heal over within a comparatively short time. This is especially true where the trunk is girdled, in which case failure to heal results in the death of the vine. Where only the fruit canes are girdled, failure of the wounds to heal does not result in the death of the vine because the root system receives some nourishment from the shoots which grow from the renewal spurs and other parts of the head of the vine below the wounds. The food material received, however, is usually insufficient to allow the root system its full development and some weakening results.

OBJECTS OF GIRDLING

Vines are girdled in an effort to accomplish one or more of three things: (1) to improve the set of berries or increase the number of berries to a cluster; (2) to increase the size of the individual berries; and (3) to hasten maturity. Each of these effects may be obtained within certain limits by complete girdling at the proper time. It is quite evident from a study of the experimental data now available that the effectiveness of the girdling wounds in influencing the behavior of the crop decreases very rapidly as the wounds heal over. The girdling must be done, therefore, at such a time that the wounds will be open and effective at the time the particular phase of development which we desire to influence is occurring. The stage at which the operation is performed is probably the greatest single factor in determining the nature and magnitude of the effect obtained.

Increase in the quantity of crop results both from an increase in the number of berries to a cluster and from an increase in the size of the berries. This is the real reason for girdling the Black Corinth variety which is a very shy bearer without girdling. With most varieties, however, increase of crop in this way is obtained only at too great a cost in loss of quality of the fruit and vigor of the vines.

INFLUENCE OF GIRDLING ON SET OF BERRIES

All cultivated varieties of grapes usually produce so many flowers that if each flower should set and produce a berry all of the clusters would be compact. Many flowers fail to set owing to lack of fertilization or other causes. With most varieties the unfertilized flowers fall very soon. Other varieties produce small, round seedless berries (shot berries) from some of the unfertilized flowers. The power to set and mature these shot berries varies greatly among varieties. Most varieties

mature very few, while some, such as the raisin Muscat, produce many. At the extreme is the Black Corinth which rarely produces any normal-seeded berries, and without girdling often fails to set at all. The shot berries in the Muscat are a serious defect but with the Corinth they are its chief merit if they are large and numerous enough to fill the cluster. The setting and subsequent development of the *seedless berries,* either on Black Corinth vines or vines of other varieties, can be greatly influenced by girdling. The setting of *normal berries* is not influenced by girdling during or after blooming. Girdling Muscat or other similar varieties therefore at any time after the beginning of bloom does not improve the set of large berries but may increase the number of shot berries.

Thompson Seedless produces berries containing only indistinct rudiments of seeds but there is some evidence[2] that a partial fertilization of the flowers does occur which causes the berry to develop in a more nearly normal fashion except for the seeds. Nevertheless, this variety responds to girdling in a manner very similar to that of Black Corinth. Monukka (Black Monukka) is another of the so-called seedless varieties and its response is likewise similar to that of Black Corinth. The seeds of Monukka are developed further than those of Thompson Seedless but as a rule they remain soft and tasteless. Girdling during or following blooming causes no appreciable changes in the number nor in the character of the seeds.

Girdling increases the set of shot berries primarily by reducing the extent of the normal drop which occurs very soon after blooming. Obviously, therefore, to be effective in increasing the number of berries the girdling must be done before this normal drop occurs—that is, during or immediately after bloom. It is most effective when done during bloom.

INFLUENCE OF GIRDLING ON SIZE OF BERRY

The enlargement of the berries can be hastened and their ultimate size considerably increased by a girdling timed to be effective during the period of rapid enlargement. This increase in size of berry is very desirable in Thompson Seedless and Monukka where grown as table grapes. With seeded varieties the increase of size of the normal berries is slight, although any seedless (shot) berries they may have are much enlarged. The average increase in the size of seedless berries of all

[2] Oinoue, Y. Contribution à l'obtention de raisins sans Pepins, La Pseudo-Fécondation Dans Les Vignes Apyrènes. Revue de Viticulture. 45:399–400. 1926.

varieties, that is, of seedless varieties or shot berries of other varieties, obtained by girdling when the berries are approximately one-fourth grown is about 40 per cent. The increase in size of normal-seeded berries obtained from similar girdling is only approximately 10 per cent. Girdling can therefore be recommended as a practicable means of increasing the size of seedless berries but not of normal-seeded berries.

INFLUENCE OF GIRDLING ON TIME OF RIPENING

Open girdling wounds present during the ripening period generally hasten maturity. Advances as great as two weeks can be obtained by making a wide wound when the berries are about one-half grown and keeping this wound open and effective during the ripening period. Such wounds, however, fail to heal and remain permanently open. The practice can therefore be employed only on parts of vines such as one or two individual fruit canes, leaving the remainder of the vine unaffected so that the roots are not starved. It has not yet been demonstrated that such girdling is commercially practicable and it is not recommended.

Girdling such as that described and commonly used to increase the set of berries and the size of berries has not been found to hasten maturity. This is clearly shown in table 2 for Black Corinth and in table 3 for Thompson Seedless. The wounds heal over comparatively soon and are not effective during the ripening period.

HEALING OF THE WOUNDS

Girdling wounds, from 3/32 to 3/16 inch wide, made at some time between the beginning of bloom and when the berries are one-half grown heal rapidly. Covering the wounds to lessen drying-out facilitates healing. Trunk girdles covered either with soil or cheese-cloth bandages heal within four weeks. Uncovered wounds on the trunks heal in from four to six weeks and uncovered wounds on fruit canes usually heal within six weeks.

Table 1 shows the time required for the healing of girdling wounds made at some time between the beginning of bloom and when the berries are one-fourth grown.

Wounds made later in the season heal more slowly because the cambium cells are less active.

TABLE 1

TIME REQUIRED FOR GIRDLING WOUNDS TO HEAL

Place of girdling	Number of wounds examined	Covering	Number of wounds 75 per cent or more healed over					
			After 3 weeks	After 4 weeks	After 5 weeks	After 6 weeks	After 7 weeks	After 8 weeks
Trunk	287	Cloth bandages	280	287	....	....	....	....
Trunk	6	Earth	5	6	....	....	....	....
Trunk	23	Not covered	9	21	23	....	....	....
Canes	117	Not covered	16	89	111	113	113	113

RECOMMENDATIONS FOR GIRDLING BLACK CORINTH

Increases in crop and in size of berry are the responses desired in Black Cornith. The increase in crop results from both increased set and increased size of berry. This variety is very early and the berries develop very rapidly after blooming. Hence, the best results both in improved set and increased size of berry are obtained by girdling

Fig. 1.—Representative Black Corinth clusters.

a. Taken from a vine which was girdled while in bloom.

b. Clusters taken from an ungirdled vine.

during the blooming period. Figure 1 shows a cluster of Black Corinth grapes at *a* which was taken from a vine girdled while in bloom, and at *b* two representative clusters from ungirdled vines. The wounds made while the vines are in bloom improve set and remain effective long enough to give maximum results in increased size of berry. Table 2 shows the averaged results of four years' experimentation with this variety at Davis.

TABLE 2

AVERAGES OF FOUR YEARS' RESULTS OBTAINED FROM GIRDLING EXPERIMENTS WITH BLACK CORINTH

Time of girdling	Crop per vine, pounds	Number of berries per cluster	Weight of 100 berries, ounces	Maturity when harvested, degrees Balling
Beginning of bloom	24.0	361	1.23	25.9
End of bloom	23.6	351	1.23	25.6
Berries one-fourth grown	13.9	328	0.95	26.3
Check (not girdled)	7.1	266	0.60	26.3

These figures show that the weight of the crop of the vines girdled at the beginning of bloom and also at the end of bloom was more than three times as great as that of the ungirdled vines. The size of berry was approximately doubled. The time of ripening, however, was not appreciably changed. Other experiments, the results of which are not included in the table, show the same results when the girdling is done at full bloom. The blooming period of Black Corinth extends over a period of from 7 to 10 days in normal seasons. All of the girdling should be done within this time.

The trunks of the Black Corinth are relatively small and the rough outer bark is easily removed especially if done every year. Consequently the trunks of this variety can be girdled more economically than the individual canes. Furthermore, girdling the trunk affects the entire vine whereas girdling the individual fruit canes affects only those portions beyond the wounds. These effects are well illustrated in figure 2. The vine at *a* was girdled on the trunk and has a uniform set of good fruit. The vine at *b* was girdled on the fruit canes and has good fruit only on the shoots beyond the girdles. The few clusters on the shoots arising from the head of the vine, that did not drop off, are poor and straggly. Since the shoots from renewal spurs and other shoots in the heads of the vines bear some fruit, trunk girdling improves all of the fruit and results in larger crops of more uniform quality than does cane girdling. For these reasons it is recommended

that the girdling be done on the trunks of this variety rather than on the fruit canes. Figure 3 shows the several steps in the operation of trunk girdling. The removal of the rough outer bark is the first step and is most easily accomplished by making two knife cuts with a

Fig. 2

a. Black Corinth vine girdled on the trunk.

b. A similar vine girdled on the fruit canes. The vine girdled on the trunk has a good crop of fruit in all parts of the vine, while on the cane-girdled vine good clusters are borne only on the shoots arising from those portions of the fruit canes beyond the girdles.

single-bladed knife about two inches apart around a smooth section of the trunk. The cuts should go through the outer bark so that the section between the cuts can be removed. The knife will cut into the

live bark but no harm is done as the wound heals very quickly. A section of a trunk with the outer bark removed is shown at *a* in figure 3. The incision proper is made by means of a double-bladed knife similar to that shown in figure 3 *b*. Care must be taken to

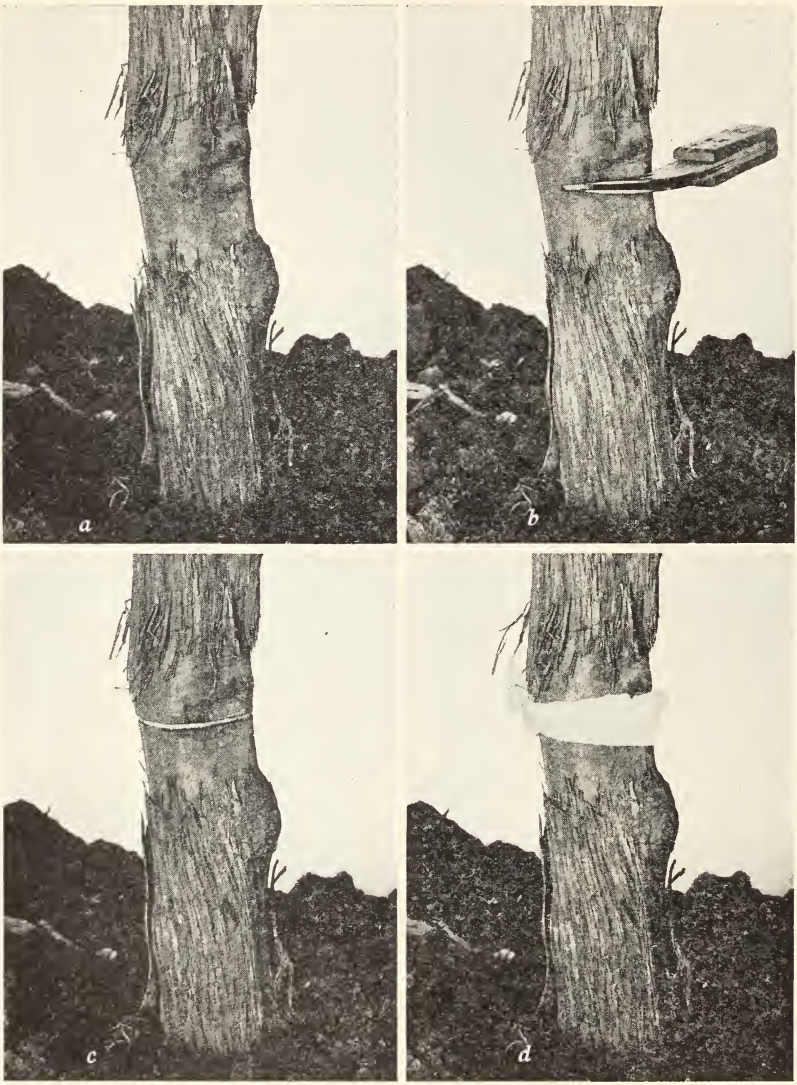

Fig. 3.—The several steps in girdling the trunks of vines.

a. The rough bark removed.

b. The double-bladed knife in position to make the incision.

c. The incision completed.

d. The wound covered with a cheesecloth bandage.

remove the ring of bark completely around the trunk and to cut as little as possible into the wood. This part of the operation is illustrated in figure 3 by *b* and *c*. After the wound is made it should be covered with a bandage of cheesecloth or other material, or, if made close to the ground, by a little mound of earth. Covering prevents rapid drying out of the tissues and facilitates rapid and complete healing of the wound. A completed trunk girdle is shown at *d* in figure 3.

RECOMMENDATIONS FOR GIRDLING THOMPSON SEEDLESS VINES

Thompson Seedless vines are girdled only to increase the size of the berries and thereby to enhance their value as table grapes. The clusters from ungirdled vines are usually either well-filled or compact and an increase of compactness due to an increase in the number of

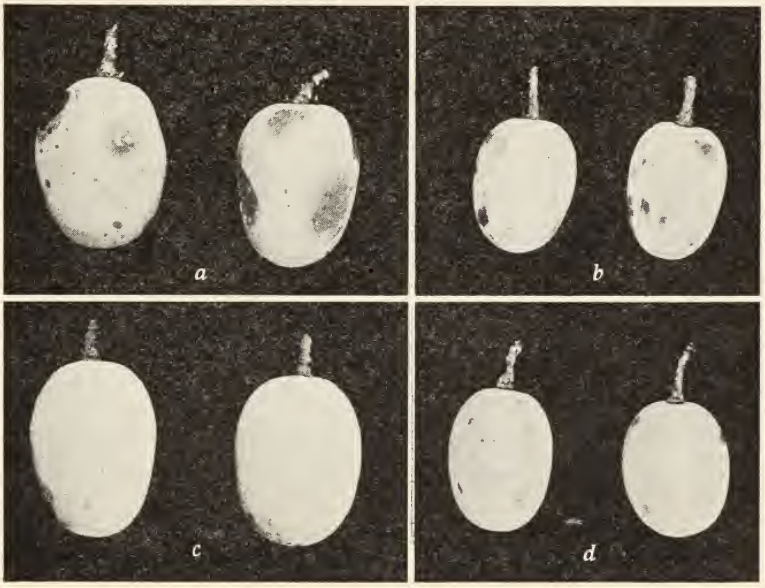

Fig. 4.—Sizes of Thompson Seedless berries. (All natural size.)

a. Girdled but not thinned.
b. Not girdled nor thinned.
c. Girdled and berry thinned.
d. Berry thinned but not girdled.

berries to a cluster is decidedly objectionable. Consequently the operation should be delayed until after the normal drop has occurred. Even then the increase in size of berry alone nearly always causes the clusters to be very compact and berry thinning should usually be employed.

The greatest increase in size of berry with Thompson Seedless is obtained by girdling when the berries are about one-fourth grown. By this time the normal drop has already taken place and the berries can be increased in size without increasing their number. Figure 4 shows the size of the berries obtained in 1928 at Davis by girdling, and by girdling combined with berry thinning, as compared with berries from similar but ungirdled vines. Delaying the girdling until the berries are one-third to one-half grown reduces the increase in size resulting from the operation.

Table 3 shows the average results of four years' experimentation with Thompson Seedless girdled at three stages—beginning of bloom, end of bloom, and when the berries were about one-fourth grown—as compared with check lots of ungirdled vines.

TABLE 3

AVERAGES OF FOUR YEARS' RESULTS OBTAINED FROM GIRDLING EXPERIMENTS WITH THOMPSON SEEDLESS

Time of girdling	Crop per vine,* pounds	Number of berries per cluster	Weight of 100 berries, ounces	Maturity when harvested, degrees Balling
Beginning of bloom	30.4	514	5.5	20.4
End of bloom	34.8	538	6.3	19.0
Berries one-fourth grown	32.4	399	7.1	19.2
Check (not girdled)	32.0	388	5.3	19.8

* In three of the four years the crop on all of the vines was caerfully thinned to equalize crops of the four lots. The slight differences in crop are unintentional and of no significance.

Girdling also causes the berries to adhere more firmly to the stems and thus reduces 'shattering' (loosening of the berries from the stems) in shipment. The pull required to break the berry from the stem was measured for about 8,000 individual berries from the vines girdled when the berries were one-fourth grown and for a similar lot from the ungirdled vines. The average pull required to break a berry from the stem of clusters from the girdled vines was 9.4 ounces, while an average pull of 7.0 ounces was sufficient to break a berry from the stems of clusters from the ungirdled vines. This is an improvement of approximately 34 per cent, and undoubtedly accounts for the frequently observed fact that fruit from girdled vines is much less subject to shattering than fruit from similar ungirdled vines.

The resistance of the berries to puncture and crushing was also measured by using a pressure tester having a plunger 3/16 inch in diameter. No difference was found between fruit from girdled and

from ungirdled vines in the pressure required to force the plunger into or to crush the berries; but it was noticed that the berries from the girdled vines were more crisp, and the plunger usually punched holes in them, while the berries from the ungirdled vines were usually crushed, rather than punctured, by the plunger. The effect of the girdling on the texture of the berries is probably of negligible importance.

Thinning Girdled Thompson Seedless Vines.—In the case of this variety the increase in quantity of crop and compactness of the clusters resulting from girdling are undesirable and must be largely prevented in the production of fine table grapes. Overcropping causes late maturity and poor texture of the fruit as well as serious weakening of the vines. Very compact clusters are subject to rot in most seasons. Those that are not so compact as to actually rot in the center may yet be so tight and unpliable that they can be packed only with great difficulty. Delaying the girdling until the berries are approximately one-fourth grown helps in keeping down both excess of crop and compactness of cluster by allowing the normal drop of berries following bloom to take place. However, thinning must usually accompany the girdling. The type of thinning to be employed will be determined by the character of the clusters. If they are mostly loose and not too large, which is seldom the case, enough entire clusters may be removed to limit the crop to the capacity of the vine. This type of thinning is commonly called 'cluster thinning' and should be done at or very near the time of girdling. Girdling at any time after the beginning of bloom does not appreciably affect the development of the stem framework of the cluster; clusters from girdled vines are little longer than those from similar ungirdled vines. Hence, increased size of berry, or more berries, or both can result only in greater compactness of the clusters. This is clearly shown by comparing *a* and *b* of figure 5. Cluster thinning does not materially affect the character of the clusters which are left on the vines but if properly done does remove those that are unusually compact or straggly, misshapen, or otherwise undesirable, so that the average quality is improved. Berry thinning or bunch cutting is the only practicable means of reducing the compactness of the individual clusters. The method most commonly used consists in cutting off the apical end of the cluster and cutting out sufficient branches from the remainder of the cluster to give it the desired looseness. In the experiments conducted at Davis it was necessary to remove at least one-third of the berries in order to obtain the desired reduction in density. Figure 5 shows clusters which are representative of those obtained. The thinning

was done at the time of girdling, that is, when the berries were approximately one-fourth grown. The practice and methods of berry thinning are discussed fully in Bulletin 492, "Berry Thinning of Grapes." Berry thinning further slightly increases the size of the berries and slightly hastens ripening. However, additional increases, of the magnitude reported in Bulletin 492 from berry thinning alone, are not obtained if girdling is also practiced. In the experiments at Davis the increased size obtained by berry thinning in addition to girdling over that obtained by girdling alone has amounted to about 5 per cent. Berry thinning on girdled vines, therefore, should be used primarily to decrease the compactness of the clusters.

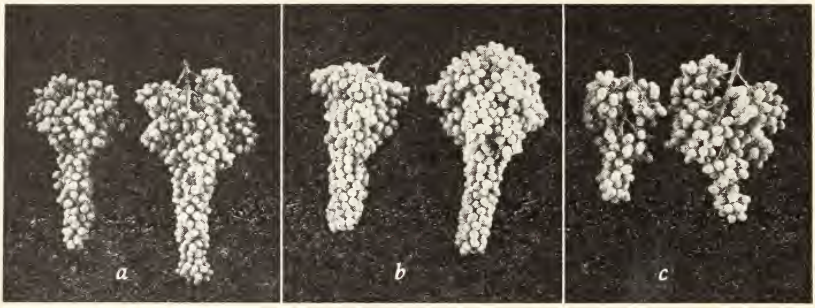

Fig. 5.—Representative Thompson Seedless clusters.

a. From ungirdled vines.
b. Unthinned clusters from girdled vines.
c. Berry thinned clusters from girdled vines.

Manner and Place of Girdling Thompson Seedless.—Unlike the Black Corinth, Thompson Seedless produces very little fruit on the shoots that grow from the renewal spurs and other parts of the head of the vine. Also, the trunks are large and the outer bark very hard and difficult to remove. For these reasons girdling the fruit canes is cheaper than and quite as good as girdling the trunks. The girdle should be located just below the first fruit-bearing shoot on each individual fruit cane. All of the sterile shoots near the base of each cane should be left below the girdle where they can nourish the head, trunk, and roots of the vine without interference, and so that they can be used as fruit canes or renewal spurs the following year. The wounds on the canes need not be covered, for if they heal imperfectly it is not serious, since anyway they are to be removed at the next pruning. The wounds should, however, be narrow and cleanly cut so that they heal over at least in part and thus reestablish bark connection with the rest of the vine. Care must be exercised in cane girdling

in order to avoid cutting too deeply into the wood. Cutting deeply into the wood may reduce the water supply to the shoots beyond the wound so seriously that they will die.

Thompson Seedless Raisin Vineyards Should Not Be Girdled.— After the grapes attain a sugar content of from 20 to 22 degrees Balling the fruit on girdled vines ripens very slowly and may never go beyond 22 degrees while the fruit on ungirdled vines usually continues to ripen rapidly until a sugar content of at least 24 degrees is reached. Thompson Seedless grapes to be dried for raisins should not be picked until they reach at least 24 degrees if raisins of good quality are to be produced, and the riper the grapes are when picked the better the raisins, other conditions being equal. Grapes of only 22 degrees dry into hard, light raisins which go into the lower grades. The large, green grapes from girdled vines produce large, hard, light raisins which are little or no better than raisins from ungirdled vines picked at a similar stage of ripeness. Girdling may greatly improve the quality of grapes for table use but it lessens their value for raisins.

RECOMMENDATIONS FOR OTHER VARIETIES

Monukka behaves like Thompson Seedless, and what has been said for Thompson Seedless applies to this variety as well. Seedless Sultana has not been used in any of the experimental work but its nature makes it seem likely that it would respond to girdling in a manner very similar to Thompson Seedless.

Malaga, Ribier, Molinera (Red Malaga), Emperor, Ohanez, Rodites, and Henab were used in the experiments for one year only. The shot berries of these varieties were affected very much as were the usual berries of the seedless varieties, but the large-seeded berries were improved only slightly. Therefore, *girdling is not recommended for such varieties.*

INFLUENCE OF GIRDLING ON THE VIGOR OF THE VINE

Girdling is weakening because it deprives the root system of the food supply coming from the shoots above the girdle. The roots continue to absorb water and mineral nutrients and pass them on to the remainder of the vine. The removal of a ring of bark, however, stops the downward movement of organic food materials until the wound is healed and the roots undergo a certain degree of starvation which checks their growth. The checking of root-growth is in turn

reflected in the checking of shoot-growth and a slight yellowing of the leaves. The degree of weakening depends upon the quantity of crop that the invididual vines carry, the place of girdling, the length of time the wounds remain open, and upon the fertility and moisture condition of the soil. The grower can reduce the extent of weakening to a minimum by giving careful attention to regulation of crop by thinning and to irrigation. Girdled vines must be irrigated more frequently than ungirdled vines in order to maintain adequate moisture in the soil in all parts of the root zone during the period that the girdle is effective and until the crop is mature or the vines have recovered their normal green color. If proper attention is given to thinning and irrigation the weakening effect is not serious and the same vines may be girdled year after year. In the experiments at Davis, girdling for four consecutive years reduced the annual growth of the Thompson Seedless vines less than 10 per cent and that of the Black Corinth about 18 per cent.

GIRDLING TOOLS

The tools commonly used in California for girdling vines are of two types, double-bladed knives and pliers. The double-bladed knives may be used on either trunks or fruit canes, while the pliers are used only on fruit canes. The best pattern for the double-bladed knife is that shown in figure 3. The blades measure 2¾ inches from the points to the handle and are 1 inch wide near the handle. The cutting edges of the blades are curved on approximately a 4-inch radius and the backs of the blades curve more, so that each blade ends in a point. The inside surfaces of the blades are ground straight and the outside surfaces beveled. They are rigidly mounted so that the cutting edges at the points are ⅛ inch apart and at the base of the handle they are 3/32 inch apart. The backs of the blades are wider apart than the cutting edges. In using the knife, the points are forced into the bark and then the knife is slowly rolled around the trunk or cane under sufficient pressure to cut completely through the bark. The ring of bark removed is held between the blades owing to the tendency of the bevel on the outside to crowd the blades together.

Figure 6 illustrates the use of the Saubusse pliers, made in France, which at the present time (1931) are not available in California. Owing to the difficulty of obtaining these French tools, several growers have constructed girdling pliers of their own and used them with varying degrees of success.

Fig. 6.—Cane girdling by means of the small Saubusse pliers. The shoots adjacent to the place of girdling were removed to show the operation more clearly.

SUMMARY

Girdling consists in the removal of a ring of bark from 3/32 to 3/16 inch wide entirely around some member of the vine. In commercial vineyards girdling the trunks is recommended for Black Corinth and girdling the fruit canes for Thompson Seedless.

With the seedless varieties the number of berries to a cluster can be increased by girdling when the vines are in bloom. This is of practical importance in increasing the crop of Black Corinth which usually drops most of its blossoms when not girdled.

The size of the berries of Thompson Seedless and other similar seedless varieties can be increased about one-third by girdling when the berries are approximately one-fourth grown. Thinning, usually berry thinning, should accompany the girdling to prevent overbearing and to reduce the compactness of the clusters.

Normal seeded varieties respond to girdling much less favorably than the seedless varieties, and girdling is not recommended as a means of improving the quality of such varieties.

While ripening can be slightly hastened by girdles which are open and effective during the ripening period the practice of girdling

for this purpose is not recommended because the wounds heal very slowly and imperfectly with a consequent serious weakening of the vine. Narrow wounds made during bloom or before the berries are one-third grown heal rapidly and have little effect on the ripening.

When Thompson Seedless is grown for raisins the vines should not be girdled. Raisins from girdled vines are usually of inferior quality.

Girdling is a weakening operation and girdled vines require more careful attention to thinning and irrigation than ungirdled vines. If not overcropped and if irrigated somewhat more frequently than is necessary for similar ungirdled vines, vines on fertile soil may be girdled each year for several years without serious weakening.

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